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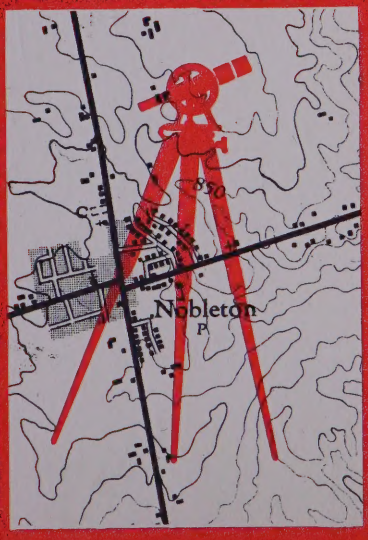
SURVEYING AS A CAREER

PUBLISHED BY THE CANADIAN INSTITUTE OF SURVEYING



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SURVEYING AS A CAREER

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The text of this brochure was prepared by H. G. Classen from material supplied by the Education Committee of the Canadian Institute of Surveying — R. T. McCurdy (Chairman), G. Babbage, D. W. Farley and L. E. Pelton.

How to use this booklet

This booklet is written for young men who are interested in becoming surveyors. It assumes that its readers will fall mainly into two groups — those who are as yet undecided about their careers and for whom surveying is just one of several professions among which they may choose; and those who are already more or less set on becoming surveyors and would like to know the steps to take to enter the profession.

The first group will probably be interested, first of all, in the sort of work a surveyor does, the influence this work has on his daily life, his place of residence, and his earnings; which interests and aptitudes are associated with surveying; and how surveying fits into the broad fabric of Canadian society. These questions are dealt with in Section A.

The second group, on the other hand, will find their answers chiefly in Section B. This section describes, first, how the profession is organized, and second, which educational opportunities are available and the requirements one must meet to become a surveyor.

It does not follow from the foregoing, of course, that readers need concern themselves only with Section A or B, depending on their knowledge and intentions. Young men who have read about the work and life of surveyors and feel attracted to it will naturally want to go on to the second half of the booklet to find out how this desire can be fulfilled. And again, those who are already acquainted with surveying in general may find new information in Section A.

What does a surveyor do?

Surveying has been defined as the art or science of measuring the physical features and boundaries of any portion of the earth's surface, and delineating them accurately on a map or plan.

The portion of the earth's surface may be a continent or it may be the foundation for a cottage. Obviously there is a great difference between the survey of a continent and the survey for a cottage foundation and, as in most fields, specialties have developed.

Geodetic surveyors make precise surveys of large areas taking account of the curved surface of the earth; topographic surveyors delineate the topographic features of the country such as mountains, lakes and rivers; hydrographic surveyors measure the depth of water in lakes and oceans; mine surveyors establish the length and direction of mine shafts and adits; construction surveyors set out the stakes to guide construction crews and land surveyors make all surveys pertaining to property boundaries.

As land surveyors constitute the largest group that is occupied solely with surveying their activities will be discussed in some detail.

It is clear that before man can take possession of new land he must know what he is taking possession of, both for his own practical advantage and to secure his claim against others. It is therefore not surprising that discovery, exploration, and surveying have usually gone hand in hand. The property survey is the first firm link between man and land. And "property" here means not only a lot to build a home or factory on, but also road and railway allowances, parks, Indian reserves, mining claims, and many other landed property rights, up to the survey and maintenance of national and provincial boundaries.

Surveyor uses theodolite in subdivision survey. Surveyors have always been in the vanguard of civilization and settlement.

Only fully registered members of the land surveying profession are authorized by law to carry out property surveys. In this respect, land surveyors are in the same category as lawyers. Before they can legally set up a practice, either on their own account or in the employment of others, they must be licensed by a federal or provincial authority. Should they fail to do so they would run afoul of the law, with all the unpleasant consequences. Property surveys are therefore called mainly "legal surveys" because they generally define the limits of legal rights or interests in land. Land surveyors thus enjoy a certain monopoly in their work. This, however, also entails a social responsibility in regards to professional competence, impartiality, and honesty.

There are challenging opportunities for graduates in survey engineering to take postgraduate work and follow a career in research or teaching. The National Research Council has a small but outstanding section on photogrammetric research and some government departments either have or plan to have research groups.

There is a growing requirement for teachers with high qualifications to meet the needs of the four universities and five technological institutes that give degrees or diplomas in surveying and at virtually every engineering faculty to give the elementary courses in surveying that are part of the general engineering education program.

What makes a good surveyor?

Five personal attributes, above all, are needed by the successful surveyor: (1) A natural inclination to be methodical and exact, (2) an aptitude for applied mathematics, (3) **a senseof responsibilities, professional conscience and integrity,** (4) **a critical mind capable of analysis and correct judgment,** (5) **aptitude for direction and initiative.**

If you should merely be drifting into surveying because of accidental circumstances without feeling a definite attraction for it, you should certainly ask yourself some searching questions. Shy persons have by sheer willpower trained themselves to act like extroverts, and others, through determined cramming, have mastered sciences that held no fascination for their minds, but it is only fair to warn you of such difficulties.

On the other hand, if you feel a genuine attraction to mathematics, an outdoor/indoor life, and leadership you can hardly pick a more satisfying career.

Historical background

As we noted earlier, surveying has gone hand in hand with discovery, exploration, and development of land. It is only natural that accurate and durable surveys should have originated in those areas of the world where land tenure was most valuable and important—the fertile deltas of Mesopotamia and Egypt, where evidence of surveys goes back 5,000 years or more. With the spread of agricultural and urban civilization surveys spread too.

It was not until the end of the Middle Ages, however, that the introduction of more complicated techniques such as astronomic position-finding and the use of precise optical instruments brought about surveying in the modern sense.

Without the surveyor the opening of the North American continent to settlement would be hard to imagine. Always advancing with the pioneer homesteader and roadbuilder, and often well ahead of them, the surveyor provided that slender but indispensable vanguard without which settlement would have been utterly chaotic and lawless.

Right from the origin of Canada (New France), there was a profound concern for exact surveying. Champlain, the founder of Quebec, set up the first maps. The first scientific teachings, early in the 17th Century, both at the Jesuite College and the Quebec Seminary, dealt with the sciences needed by the Surveyors: mathematics, topography, hydrography, surveying and mapping. Public administra-

This surveying landmark, the oldest in the Canada Landmark Collection, was discovered a few years ago by surveyors working on the Caughnawaga Indian Reserve, on the outskirts of Montreal. It was originally set up in 1762.

tion right from the founding of our Country benefited with the services of Royal Surveyors' (Arpenteurs royaux) whose responsibilities were to prepare maps, subdivide the territory into seigneuries, this responsibility was later carried by provincial surveyors after 1760.

Many of the early surveys, it is true, were carried out directly by government agencies. Thus several of the surveys of the Canada-United States boundary were done by Royal Engineers under the authority of the British Foreign Office. The survey of the water boundary through the Great Lakes system and that of the Alaska boundary, however, were carried out by civilian surveyors, the first of them by the famous explorer David Thompson.

Nevertheless, until the middle of the 19th century surveyors in Upper and Lower Canada (the present Ontario and Quebec) continued to be under the immediate authority of the Surveyor General, according to whose instructions they performed their work. In 1849 a new act on the training and licensing of surveyors in the Canadas paved the way for the emergence of surveying as an independent profession, the government's role being confined chiefly to the enforcement of standards of competency.

What might be called the Heroic Age of surveying in Canada began around 1872, when the newly acquired "Northwest Territories" were declared Dominion Lands and the southern portions (now the three prairie provinces) were surveyed and opened to settlement. To spearhead that enormous task, a body of Dominion Land Surveyors was created in 1874. The banner year was 1883, when 119 survey parties were at work on Dominion Lands, comprising 1,200 men. In that survey season, 1,221 townships were sub-divided and a further 1,380 outlined, and the total mileage of lines surveyed came to 81,300.

Survey team in Manitoba, 1886. The surveying of the Prairies in the 1880's was one of the greatest feats in the history of land surveying.

If you have a large map of Canada, look at the boundary separating Manitoba and Saskatchewan. Its southern portion does not run straight but zigzags, as it were, following early township lines. Even the makers of provinces had to acknowledge the primacy of the surveyor.

With the transfer of most of the land south of the 60th parallel to provincial jurisdiction and the rapid growth of municipal and private holdings, the number of Dominion Land Surveyors shrank steadily, while that of provincial surveyors in the new lands grew in proportion. At present, federally commissioned surveyors make up only a small body compared with the various provincially commissioned surveyors.

Highly significant have been the historical changes in methods and instruments. Air photography and electronic distance-measurement, though they are so far being used more in mapping than in legal surveys, will no doubt play an increasingly important role in the everyday life of the land surveyor and demand from him greater theoretical knowledge than that possessed by his predecessors. Photogrammetry — the science of producing maps from air photographs — has grown by leaps and bounds in the last several decades and has revolutionized that part of surveying having to do with map-making. Legal and technical requirements and considerations are constantly growing in complexity. Whereas in the older days a surveyor's education could be regarded as practically complete by the time he was licensed to practice, the modern land surveyor must continually update and revise his knowledge and his methods. Surveying is turning from a craft into a science, a fact that will become clear later in this booklet when we describe educational requirements.

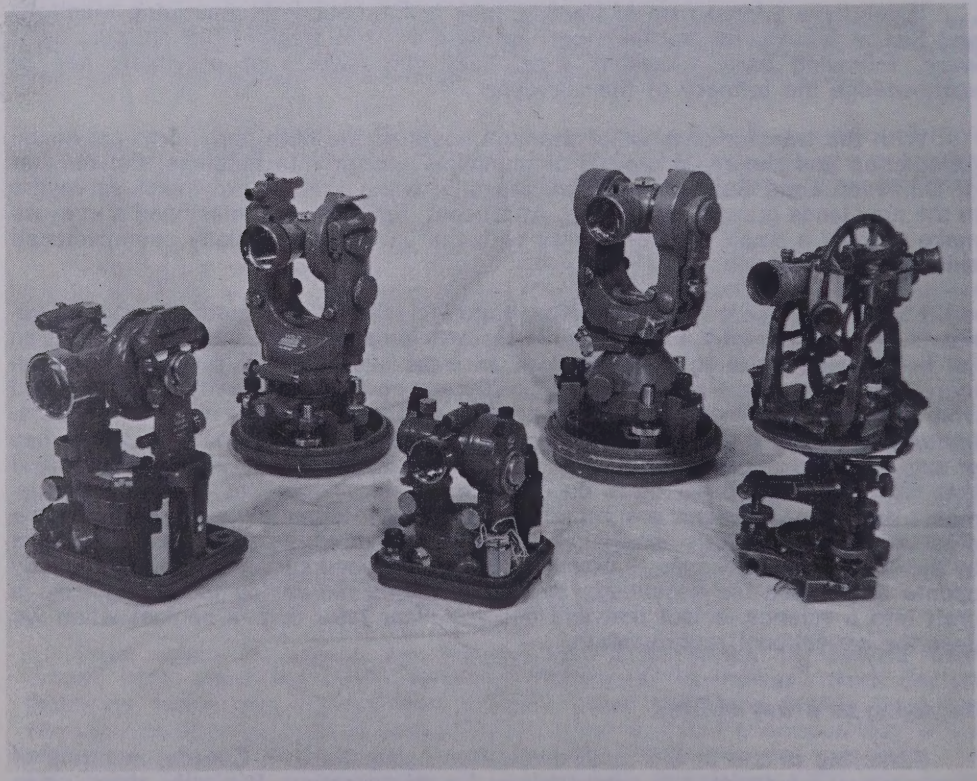
Surveying as a way of life

Surveying is one of the most diversified occupations in Canada, in terms of employment, residence, and opportunities for advancement. Basically, three types of career are open — licensed surveyor, survey engineer and survey technician.

The licensed surveyor may set up a private practice; he is self employed and obtains his income from services rendered to owners of land, either independently or in association with a private survey firm. Most of his surveys are property surveys, that is, having to do with measuring real estate. They have, generally, two objectives: (1) to provide the client with visual evidence of the limits of the lands in which legal rights are being defined. This is usually done by placing monuments or markers on the boundaries of the lands concerned: (2) to provide the client with a description of the lands which will be incorporated or referred to in the legal documents relating to the transaction. This may take the form of written words or, more simply, a plan. It is obvious that the land surveyor in private practice must have a sound knowledge of municipal and provincial regulations. Some of these differ from city to city and from province to province.

There are approximately 1,800 licensed land surveyors in Canada. Their distribution among the types of employment mentioned above varies from province to province. In Ontario, for example, which has 565 Ontario Land Surveyors, a little over half are in private practice. In New Brunswick, with about 80 surveyors, one third are in government service and a little less than half in private practice. In Quebec, there are 350 Land Surveyors (Arpenteurs-géomètres) distributed as follows: 50 percent in private practice; 25 percent in Provincial or Federal administration; 15 percent with cities and other agencies; 10 percent not practicing.

The surveyor who is employed by an industrial concern is in a somewhat different field of work. Generally, his surveys will be directly related to the expansion of the company for which he works. Many of these surveys, of course, will not fall within the category of legal surveys and could therefore also be done by specialists who are not licensed land surveyors. It is obvious, however, that a licensed surveyor has particular advantages to offer to a company, since he may be employed on both legal and other types of surveys.

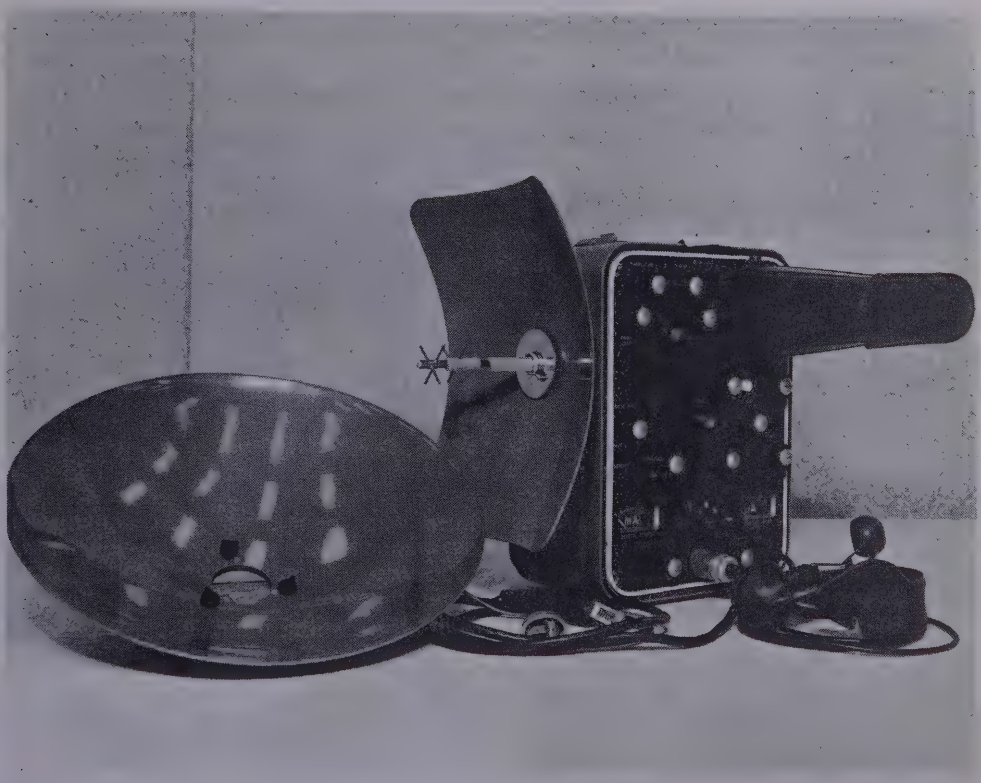


Several types and makes of theodolites currently used by surveyors.

There are in Canada a few companies that specialize in making maps and plans on contract using photogrammetry and other sophisticated techniques. These companies work on a world-wide basis. This is challenging and exciting work that calls for highly skilled and versatile survey engineers and technicians. They may be surveying a route for a railroad in Northern Quebec, for an irrigation project in the Middle East and for mining development in South America all within one year.

The most extensive surveys are carried out by surveyors employed by the municipal, provincial, or federal governments. They do a great deal of mapping, in which they rely heavily on aerial photography and electronic distance-measurement. Here again, though much of the work may not fall within legal surveys, the versatility and sound training of the licensed land surveyor command important advantages.

Surveyors seldom work alone in the field. The typical survey party consists of the chief, who may be a licensed surveyor, plus three technicians. These would include an instrumentman who sets up and operates such instruments as the theodolite, transit, level, tellurometer, and geodimeter; and chainmen, who measure distances between points designated by the surveyor by using a steel tape, or rodmen, who use a level rod, stadia rod, or range pole to assist in measuring elevations, distances, and directions. In addition, there may be axemen to help clear lines through bush and forest and to perform other simple tasks. Apprentice surveyors will carry out all these tasks at some stage of their career; there is no better preparation for a man who plans to do a stint of that work himself.



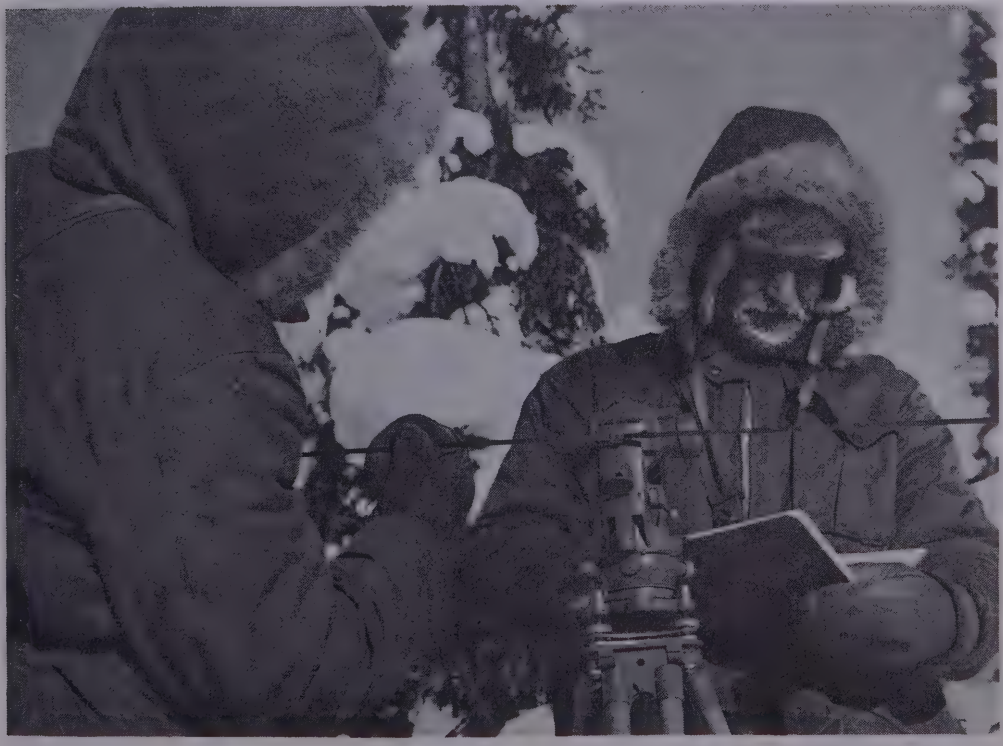
Tellurometer, the tellurometer measures distances by electronic microwaves. Hellicopters and light planes are generally used to transport surveyors over difficult terrain.

Geodimeter, an electronic distance-measurement instrument that uses the speed of light to determine exact distances.

Tellurometer party in British Columbia.

Legal survey party using geodimeter.

Effective leadership and teamwork are essential for a successful survey. Surveyors sometimes spend days or weeks with their men in the bush, in tents, working, eating, and relaxing together, and under these circumstances the surveyor's ability to retain both the loyalty and the respect of his technicians is



"Chainers" use steel tape and theodolite in the survey of the boundary between Saskatchewan and the Northwest Territories.

tested continually. It is said that no man is a hero to his valet and that familiarity breeds contempt; consequently it is all the more remarkable that surveyors often recall with fondness and admiration the old masters of the science under whom they trained.

The discussion above explains why surveying is not a particularly suitable profession for women, and although there are no rules to exclude them there are at present no licensed women surveyors in Canada. However, there are good opportunities and suitable jobs for women technicians in offices and drafting rooms. It might be pointed out that it is not necessary to be licensed as a land surveyor or to be a university graduate to do surveying. Survey technicians are much in demand, and the growing field of photogrammetry offers interesting employment.

Not all of the surveyor's work is out of doors. All surveyors, no matter where employed, spend a considerable proportion of their time in their own and other offices, where they prepare descriptions, plans, search title and survey records, and carry out the various house-keeping tasks which are common to all enterprises. Field work predominates in summer, when working hours often stretch beyond the 40-hour week. The winter-summer work differentiation is particularly pronounced for surveyors who are in government service. Surveyors in private practice may vary their routine day to day, or even from hour to hour. As one surveyor put it, "On any typical day, one might spend time studying old documents in a registry office, tramp through the woods, talk to people concerned with a boundary problem, make measurements with tape and transit, do calculations and dig for old posts. It is this diversity that is one of the strongest attractions of land surveying.

Surveyors go wherever their clients' or employers' land may be located, and since surveyors are generally the pathbreakers of civilization and development this often takes them away from the amenities of urban living. A surveyor working for an oil company in Alberta writes: "The surveyor is faced with problems of

Surveyor uses theodelite on retracement of property boundary.

access, transportation, living, and the technical difficuties of carrying his surveys from an existing monument to the area of interest. Some locations are in extremely rugged and remote regions . . . Transportation by horses, jeeps, bombardiers, light planes and helicopters is used to varying degrees. Sad to say, sometimes we even have to walk."

Where surveyors work has a lot to do with where they and their families live. This does not mean, however, that most surveyors live on the fringes of civilization. On the contrary, they exhibit much the same residential preferences as other Canadians, and have a strong tendency to congregate in and around large cities. Partly this is due to employment by provincial governments, but even in those metropolitan areas that are not provincial capitals, such as Montreal and Vancouver, there are large numbers of surveyors.

Thus, for example, more than half of Quebec's licensed surveyors live in and around Quebec City and Montreal; two thirds of British Columbia's surveyors live in the Victoria and Vancouver areas; Edmonton has more than half of Alberta's surveyors; in Manitoba nearly three fourths of the licensed land surveyors live in and around Winnipeg. Even in Ontario, where there is a large number of sizeable cities, more than one third of the surveyors live in metropolitan Toronto. Only in the Maritimes is this pattern of urban concentration somewhat broken.

Levelling party at Highwood Pass, Alberta. Square screen is used to shield instrument from the sun.

On the other hand, land surveyors have also established their offices and, one may assume, profitable practices in such out-of-the-way places as Little Current, Ont., Terrace, B.C., Stephenville, Nfld., Ste-Rose-du-Degele, Que., and Spirit River, Alta. The profession evidently offers a great variety of permanent locations to choose from and should be as attractive to the man who likes to spend his winter evenings at concerts or fashionable clubs as to the lover of fresh country air and small-town friendliness.

The government surveyor, however, while he is likely to have his permanent residence in a large city, is also much more likely than the private surveyor to do his field work in remote areas and may not see his wife and children for months at a stretch. This is not necessarily a disadvantage for the man who likes to travel and explore strange places. Surveying as a whole is undoubtedly one of the world's "travelingest" professions. Government surveyors have found themselves working on technical-aid projects in many developing countries, and participation in international professional conferences and planning agencies may take the surveying specialist to some of the large capitals of the world.

What about earnings and opportunities for advancement? Here again the range of possibilities is wide, but annual incomes generally fall within $7,000-$12,000, depending on experience and position. Usually, opportunities for high earnings are better in private practice, but they are also subject to several uncertain factors — economic conditions throughout the country, local construction booms, personal connections, willingness to locate in otherwise unattractive areas, and so forth. In short, there is somewhat less security of income in private practice than in government employment. The private land surveyor, however, enjoys a good deal of independence and may in time build up his own firm, alone or in partnership, in which he would have the choice of going out into the field or confronting himself to managerial work. The best for him to increase his earnings is to expand his practice and to work longer hours.

In employment, whether government or industry, there is no doubt greater income security, but earnings possibilities are also more circumscribed. For the man who is theoretically inclined and interested in research and development, this type of employment is perhaps more suitable than private practice. Most of the innovations in survey techniques are brought about by surveyors who are employed by large organizations, because it is chiefly in this type of employment that surveyors are able to specialize in certain narrow and highly technical fields.

Among these fields are geodesy, topographical mapping, control surveys, hydrographic charting, geophysical surveys, town planning, forest management, and other careers, for which no professional licence may be required and where surveyors will work, and sometimes compete, with people of other educational backgrounds.

Geodesists climbing up geodetic survey tower. Geodesy is one of the specialized careers open to professional land surveyors.

It is therefore not surprising that advancement and earnings in employment depend less on general economic conditions and local booms than on education and specialization. Also, it is customary for surveyors who are moving up the corporate ladder to assume administrative duties, and many have thus become fulltime administrators whose only connection with their profession is through the work of their subordinates. In this category, salaries over $15,000 per year are not uncommon.

Technician drafting plan of survey.

SECTION B

Professional organization

Land surveying, as we mentioned earlier, is a legally constituted profession. In order to become a bona-fide land surveyor one must be accepted by a provincial or federal authority and adhere to certain rules of conduct.

In nine of the provinces the authority for examining, licensing, and supervising land surveyors is vested in provincial land surveyors' associations, though in some provinces the examining and licensing authority is shared with universities and/or provincial-government appointees. In Prince Edward Island this authority is exercised by the Deputy Minister of the Department of Public Works. In the federal field the authority is exercised by a board of examiners under the Surveyor General of Canada Lands, who is in turn an official of the Department of Energy, Mines and Resources. Surveyors commissioned by this board carry the title of Dominion Land Surveyor and are entitled to make cadastral surveys in the Yukon, the Northwest Territories, and certain federal lands within provinces. There are no land surveyors' associations to which a Prince Edward Island Land Surveyor or a Dominion Land Surveyor must belong in order to exercise his profession.

Provincial associations, however, do not limit themselves to the role of a watchdog. They also act as a clearing-house for technical information. They represent the surveyors' professional interests to the provincial government and help in the drafting and amendment of pertinent legislation. They work with educational institutions for the introduction and improvement of curricula dealing with surveying. They maintain links with survey organizations in other provinces and in the federal capital, and keep farflung members informed about developments in their field. All provincial organizations hold annual meetings, and several publish periodic reports or journals.

While there is no surveyors' association for Dominion Land Surveyors, there is The Canadian Institute of Surveying, a voluntary professional and scientific organization. Membership in the Institute is open to all persons active in surveying, whether as licensed land surveyors or in some other capacity. Many of the provincial land surveyors belong to the Institute, which also counts among its members Dominion Land Surveyors, survey technicians, photogrammetrists, engineers engaged in surveying, teachers and others. The Institute publishes a journal, **The Canadian Surveyor,** which is distributed to all members, and holds annual meetings at which many subjects of interest to the profession are studied and discussed. Total membership of The Canadian Institute of Surveying, including junior and associate members is approximately 1,500.

Many land surveyors are licensed and registered in more than one province. Each such additional registration requires a new examination, confined mainly to the points in provincial laws in which the practice of one province differs from that of the other.

The precise legislative and administrative arrangements concerning examination, licensing, and registration of land surveyors in the various parts of Canada are too complicated and diverse to be set out in detail, and students who wish to learn more about them should contact the appropriate provincial or federal agencies, whose names and addresses are given below.

The Secretary
Corporation of Land Surveyors of British Columbia
605 Courtney Street
Victoria, B.C.

The Secretary
Alberta Land Surveyors' Association
No. 100, 14224 Stony Plain Road
Edmonton, Alta.

The Secretary
Saskatchewan Land Surveyors' Association
P.O. Box 826
Regina, Sask.

The Secretary
Association of Manitoba Land Surveyors
c/o Survey Department, Land Titles Office,
Winnipeg, Man.

The Secretary
Association of Ontario Land Surveyors
Suite 903, 8 King Street East
Toronto 1, Ont.

The Secretary
Corporation of Quebec Land Surveyors
2136 Ste-Foy Road, Room 210
Quebec 10, Que. ,

The Secretary
Association of Provincial Land Surveyors of Nova Scotia
P.O. Box 1541
Halifax, N.S.

The Secretary
Association of New Brunswick Land Surveyors
P.O. Box 22
Fredericton, N.B.

The Deputy Minister
Department of Public Works
Charlottetown, P.E.I.

The Secretary
Association of Newfoundland Land Surveyors
P.O. Box H-187
St. John's, Nfld.

The Secretary
Board of Examiners for Dominion Land Surveyors
615 Booth Street
Ottawa 4, Ont.

For those whose interest lies in topographic and geodetic surveying, contact the:

Director of Surveys and Mapping,
615 Booth Street,
Ottawa 4, Ontario

and for hydrographic surveying:

Director of Marine Sciences,
615 Booth Street,
Ottawa 4, Ontario

Educational requirements

The education of surveyors in Canada is undergoing continuous change, and is one of the topics animatedly debated at all annual meetings. Land surveying is one of the few professions which does not demand a university degree but regards such a degree as highly desirable. Indeed, there is a growing demand among provincial associations that university graduation in an approved course be made mandatory.

Generally speaking, all examining boards require candidates for the profession to have high-school graduation or equivalent, to undergo a stipulated period of training in practice (articled apprenticeship), and to pass prescribed examinations. University graduates with an acceptable degree, however, may have their period of apprenticeship shortened considerably, by as much as 75 per cent, and need not take all the examinations.

To give an idea of these requirements, here is the examination schedule of the Board of Examiners for Dominion Land Surveyors, which has sometimes been used as a model for provincial examinations.

Schedule A (Initial Examination)

1. Arithmetic and mensuration
2. Algebra
3. Plane and solid geometry
4. Plane trigonometry and logarithms
5. Spherical trigonometry
6. Physics

After passing this examination, the candidate must serve for three years under articles to a Dominion Land Surveyor, twelve months of which must be in the field. He then goes on to the following examinations, though Schedule B may also be written after one year under articles.

Schedule B

1. Preparation of technical reports
2. Astronomy
3. Elementary meteorology, geology, and mineralogy
4. Analytical geometry and map projections
5. Trigonometry
6. Differential and integral calculus

Schedule C

1. Acts and regulations governing surveys in the public lands of Canada
2. Instructions governing surveys in the public lands of Canada
3. Legal principles and description for deeds
4. Elementary photogrammetry and town planning
5. Methods of surveying, calculation areas and curves
6. Theory, adjustment and use of instruments
7. Practical surveying
8. Plans and drafting

Schedule D

Carry out a field survey and submit the returns in a satisfactory manner.

University graduates holding a degree acceptable to the board of examiners need not take Schedule A. Their initial examination consists of Schedule B, after which they must serve under articles for one year, six months of which must be in the field. They then proceed to Schedules C and D. Exceptions are also made for certain provincial and other surveyors.

In Ontario, engineering graduates of the University of Toronto who have taken the necessary surveying options are required to serve one year under articles to a practicing surveyor and to write an examination on those subjects, relating mainly to survey law, which are not taught at the university. At present, non-graduates may enter the profession by serving a four-year apprenticeship and writing the full examination, which is closely aligned with university standards.

Similar requirements must be met in other provinces. In Quebec the standard apprenticeship period is four years; students taking the surveying courses at Laval University normally accumulate the required practical experience during the course of studies and are therefore admitted to the board examination immediately on graduation. In New Brunswick, the apprenticeship lasts only two years.

It is evident that in most cases the short-cut of full apprenticeship rather than university education may gain a candidate one to three years in terms of time, and it may also be easier to sustain from the financial point of view. On the other hand, the university graduate is almost certain to be ahead of the non-graduate in opportunities for advancement, and this difference is likely to increase as the years go by. Prospective surveyors should therefore weigh these educational alternatives carefully.

For those who believe they cannot manage university and who would yet like to receive more formal education than an articled apprenticeship can give, there is an intermediate way: a two-year survey course in an institute of technology, available in Nova Scotia, Newfoundland, Alberta, and British Columbia. Graduates from these courses may also have their period of apprenticeship shortened.

Educational institutions

A prospective land surveyor's choice of training and education will depend not only on considerations of time and money, but also on the distance from his home to an educational institution where courses in surveying are taught. Unfortunately the situation in this respect is not yet as favorable as the surveying community would like. However, educational opportunities are steadily expanding.

At this writing, there are four universities in Canada offering advanced courses in surveying. They are the Universities of British Columbia (Vancouver), Toronto, Laval (Quebec City), and New Brunswick (Fredericton).

There are five technical schools offering two-year courses in surveying — the British Columbia Institute of Technology in Burnaby, the Southern Alberta Institute of Technology in Calgary, the Northern Alberta Institute of Technology in

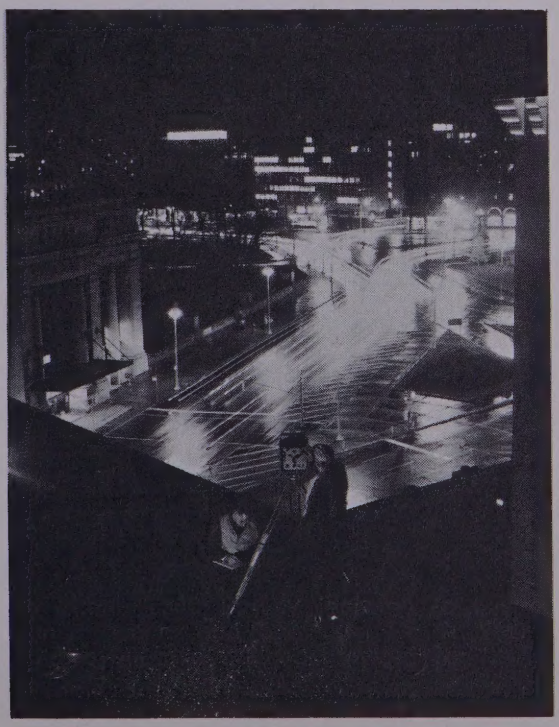
Edmonton, the Nova Scotia Land Survey Institute in Lawrencetown, and the Newfoundland College of Trades and Technology in St. John's. The present revision of the education system in Quebec provides for technological institutes where there is an option in surveying.

In the Universities of British Columbia and Toronto, survey courses are offered as an option within the Department of Civil Engineering. This means that the student wishing to study surveying enrolls in the four-year course leading to the degree of Bachelor of Applied Science in Civil Engineering, and takes a number of options not normally taken by civil engineers. These include geodetic engineering, photogrammetry, photointerpretation, geodetic astronomy, town planning, and others. The University of British Columbia has also established a one-year diploma course in surveying, which is open to university graduates having a sufficient standing in mathematics and physics.

At the University of New Brunswick and at Laval, there are independent courses in surveying, leading to a degree of Bachelor of Science in Surveying Engineering and Bachelor of Applied Science (Surveying), respectively.

At New Brunswick the courses in the first, second, and third year are identical with those of the civil-engineering curriculum. Fourth-year courses embrace such subjects as advanced surveying and photogrammetry, geodetic astronomy, advanced mathematics, optics, and cartographic drawing; fifth-year courses include advanced photogrammetry, geophysics, engineering hydrology, real-property law, municipal and transportation engineering, advanced electronics, geodesy, physical geography, etc. The university also offers courses of graduate studies leading to the degrees of Master and Doctor of Science in Survey Engineering.

Laval University in Quebec City has the oldest surveying course in Canada, established in 1907. (The courses at the other three universities were established only recently). The course is taught in French, but many of the textbooks and references are in English, and a knowledge of English is required. The complete course lasts eight semesters for candidates who have completed senior high

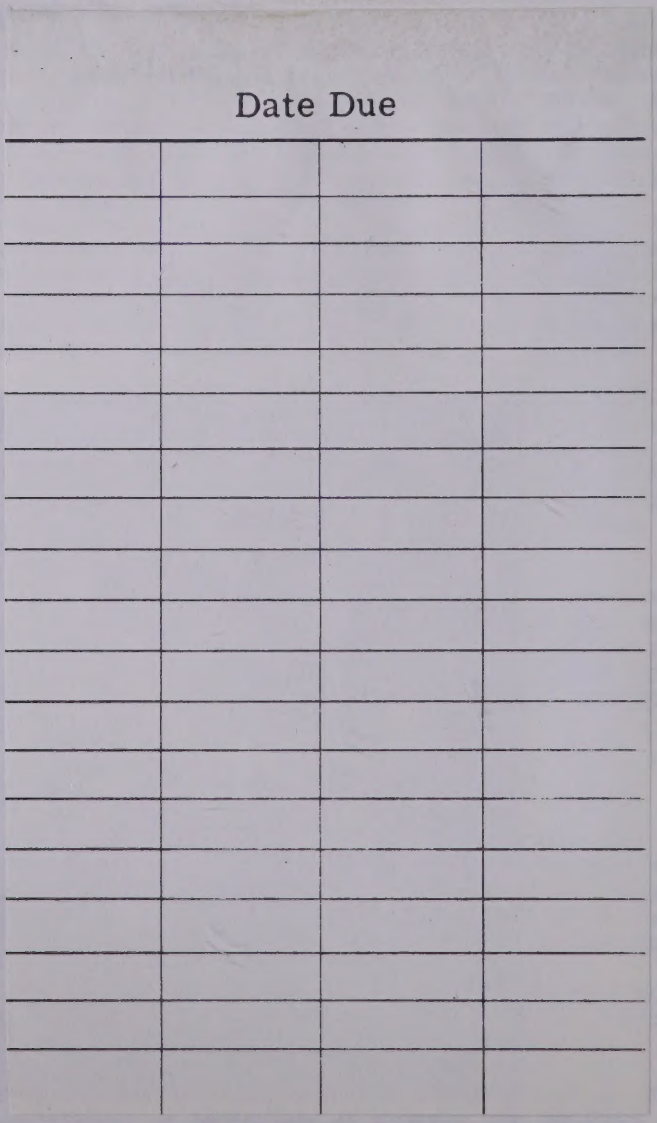


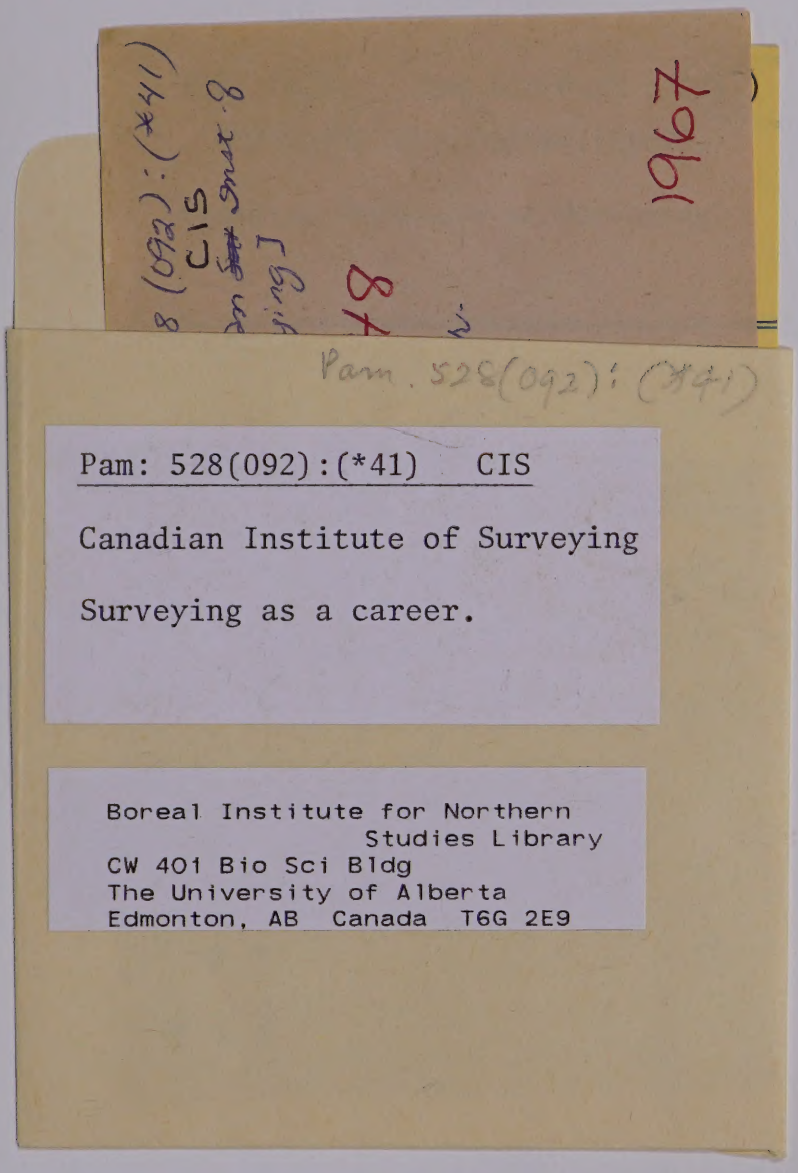
Geodimeter party has stationed itself on the roof of a building to carry out urban control survey at night.

school. Students are articled to a licensed Quebec Land Surveyor from their second year, and engage in a total of 18 weeks of field work between academic years. Laval University also offers Master's and Doctor's degrees in surveying.

It has been estimated by experts in the field that the current annual need for university-trained surveyors in Canada is about 100. Of these, private practice would absorb 44, governments 31, and industry 25, though some may also take up teaching.

No more than a sketchy outline of the various educational possibilities for land surveying can be given in this booklet, and interested persons are urged to write to the various educational institutions and the associations listed earlier for complete and up-to-date information. Teachers and practicing surveyors are more than willing to advise and encourage young men wishing to enter one of the world's oldest, most interesting, and challenging professions.





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